

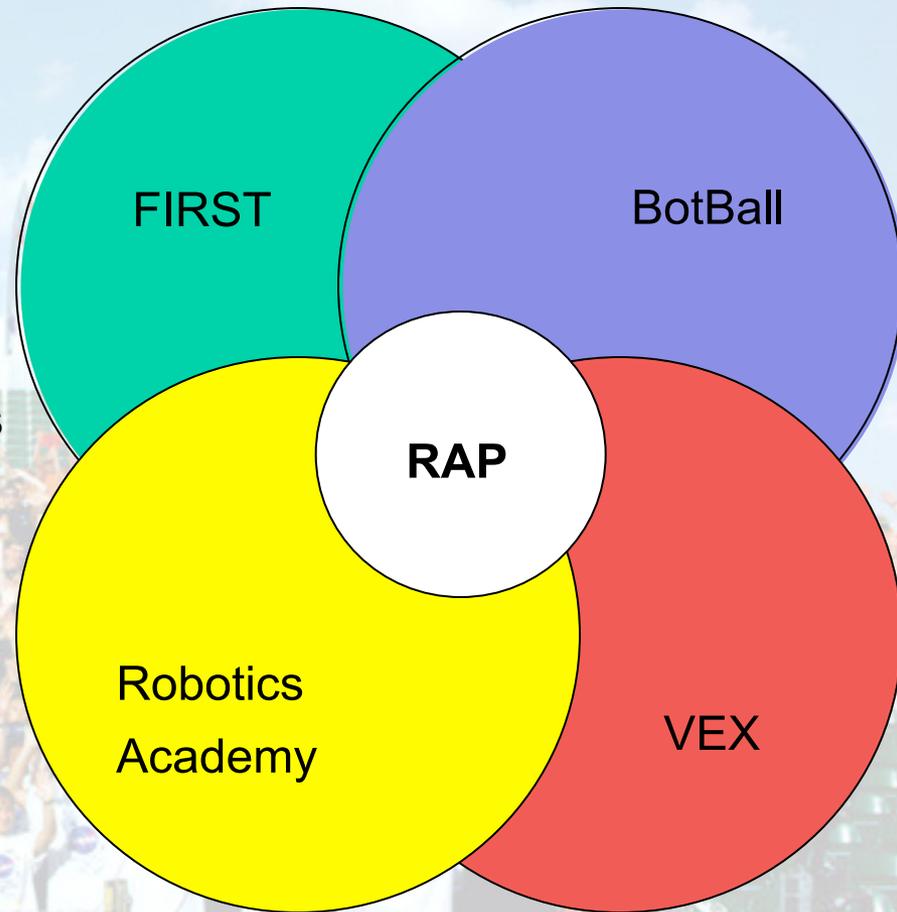
NASA Robotics Alliance Project

Technology Inspiration - Creating
Tomorrow's Engineers
For Tomorrow's Missions



What Is The Robotics Alliance Project (RAP)?

- Sourced from the NASA Telerobotics Technology Program (TRIWG)
- Objectives:
 - Replenish the national supply of (robotics) technology experts and expertise
 - Inspire the next generation of (NASA) engineers, scientists and technologists
 - Support the creation of “smart shoppers” who can make educated career choices
 - Support the creation of a new national economic engine
 - Increase the demand for advanced (robotics) technology and engineering academic programs



What Is FIRST?

- “...we see a world where science and technology are celebrated, where kids think science is cool, and dream of becoming science and technology heroes.”

– Dean Kamen, FIRST
Founder



- Non-profit organization dedicated to increasing interest in science, math and technology among youth of the United States
- Major program is the annual FIRST Robotics Competition (FRC)
- ~250,000 students (across all programs), ~48,000 students in FRC
- ~73,000 mentors and volunteers, supported by 3,500 corporate sponsors
- Teams in 50 states and 37 countries
- >\$15,000,000 in scholarships
- The product: exciting and inspiring the creation of an excited technical workforce and a technically literate society for the future of the United States

What Is FIRST?

“We want to change the culture by celebrating the mind. We need to show kids that it’s more fun to design and create a video game than it is to play one.”

Dean Kamen
Founder

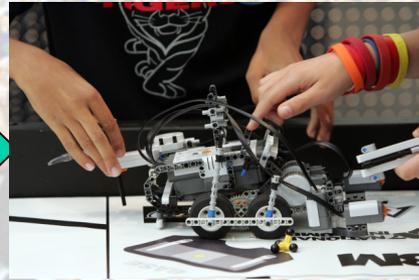
FIRST® Robotics Competition



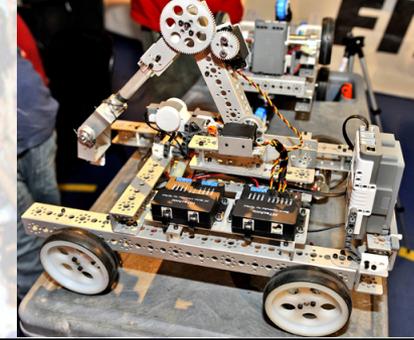
Junior FIRST® LEGO® League



FIRST® LEGO® League



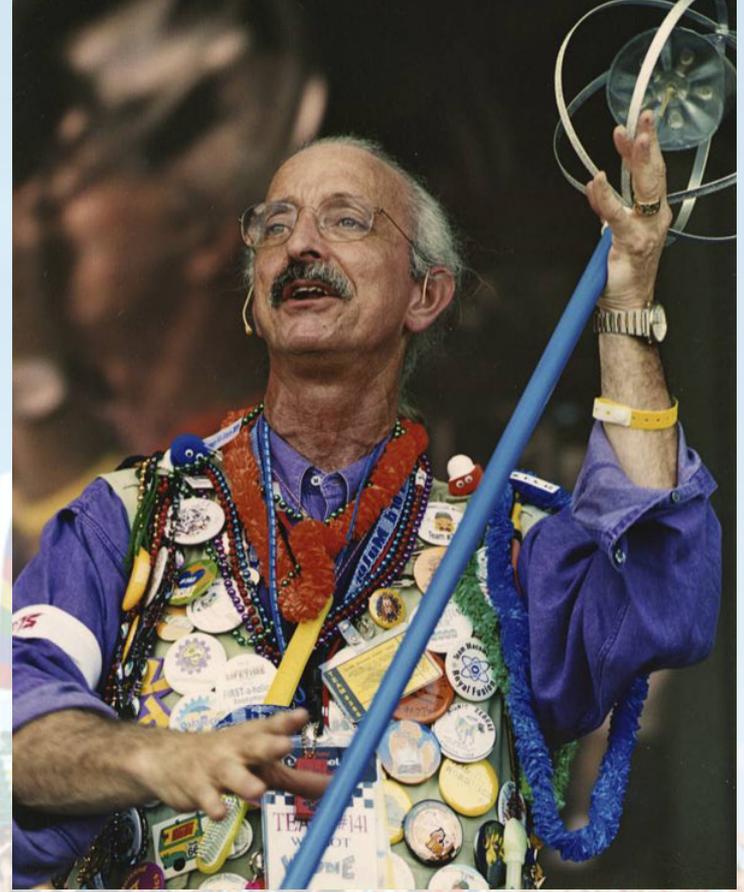
FIRST® Tech Challenge



K 1 2 3 4 5 6 7 8 9 10 11 12

Grade Level

- **Mission is to INSPIRE, not EDUCATE**
- BUT look at what is involved:
 - Math (algebra, geometry, trig, calculus)
 - Science (physics, chemistry, experimentation)
 - Language arts (writing, public speaking)
 - Business (marketing, PR, fundraising)
 - Finance (accounting)
 - Computer Science (programming, 3D animation)
 - Fabrication (woodworking, metalworking)
 - Mentorship: Working side-by-side with professionals
 - Teamwork
 - Gracious Professionalism
 - Coopertition



"...It's like life. You never have enough information. You never have enough time. The kit of materials is what you have in the warehouse. There are always competing things and you must have a strategy. We've created a microcosm of the real engineering experience."

*Woodie Flowers
FIRST National Advisor*

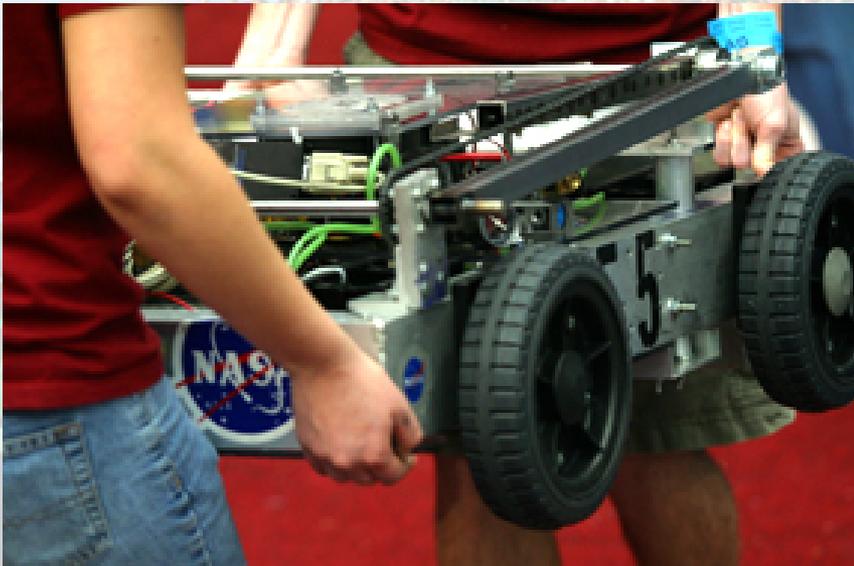
Why Is This NASA's Problem?

- Significant percentage ($>1/4$) of NASA's technical workforce is aging and approaching retirement – as they leave, we need to have a trained, competent and excited future workforce in the pipeline
- NASA demand increasing as missions expand
 - Mars Exploration Program
 - Exploration Systems Missions
 - Mars robot systems and networks
 - Outer planets exploration
 - ISS external operations
 - Personal astronaut assistant robots
 - On-orbit satellite servicing
- The academic community is not producing enough highly trained engineers
 - E.g. < 8 robotics PhD programs in the United States
- We are in competition for these engineers with other industries
- Bottom Line: we need the students that FIRST is producing



We Participate To...

- Provide inspiration to the next generation
- Follow the NASA charter to disseminate knowledge
- Implement NASA's embedded education strategy for science, math and technology
- Emphasize technology education at level consistent with science education efforts
- Introduce future employees to engineering and technical careers
- Respond to anticipated shortage of engineers to develop future missions
- Help groom new NASA managers and project engineers with “practice projects”



FRC Teams

- Professional engineers and scientists
- High school students
- Teachers, faculty and parents
- Team budget range: \$10-70K
- Team size: 10-70 (average is 20-25 students, 4-5 mentors)
 - No required student / engineer ratio or roles
 - Let each team determine these based on their resources



The Project

- Build a team and build a robot
 - EVERY aspect of a full-blown engineering project is included (design, finance, fabrication, supplies, documentation, PAO, logistics, resource management, etc)
- Go through entire project life-cycle
- Months of preparation with an intense six-week implementation period
- Strictly bounded problem with very tight constraints
 - Fixed, finite resources and materials
 - Hard limits on robot form and function - mass, volume, power limits
 - Tight, hard deadlines – absolute ship dates
 - Fixed budget constraints
 - Great analogies to NASA flight projects



The Competition

- Season kick-off the first weekend in January
 - Reveal the challenge for the season
 - Teams immediately start designing and building
- Complete robots and ship by February 22, 2011
- 48 Regional competitions throughout the country/world in March-April, 2011
- International championship competition in St Louis April 28-30, 2011
- Special events throughout the off-season
 - Havoc On The Hill (at U.S. Capitol)
 - Indiana Robotics Invitational
 - Brunswick Eruption
 - Virginia State Fair
 - Etc.

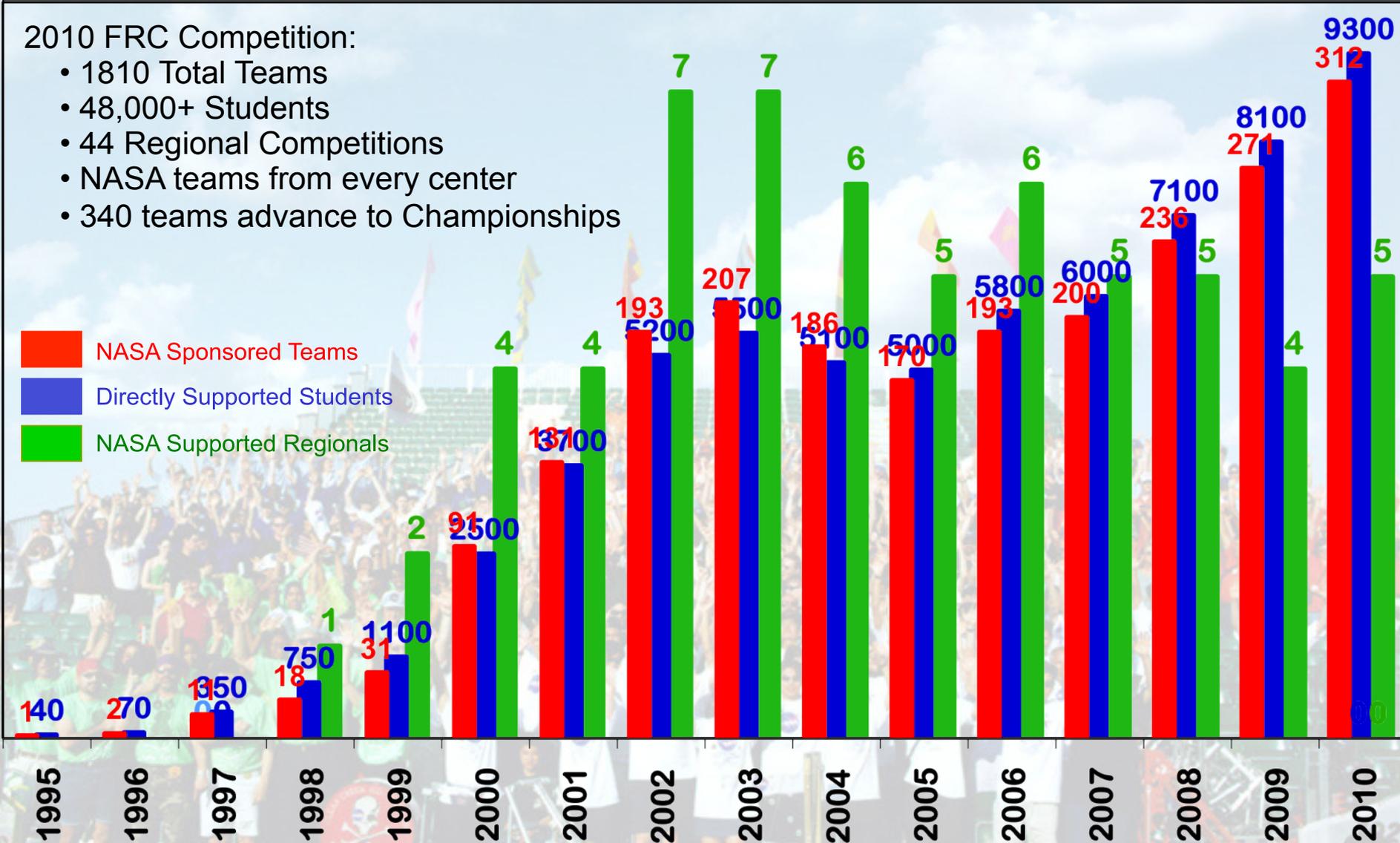


NASA Participation In FRC

2010 FRC Competition:

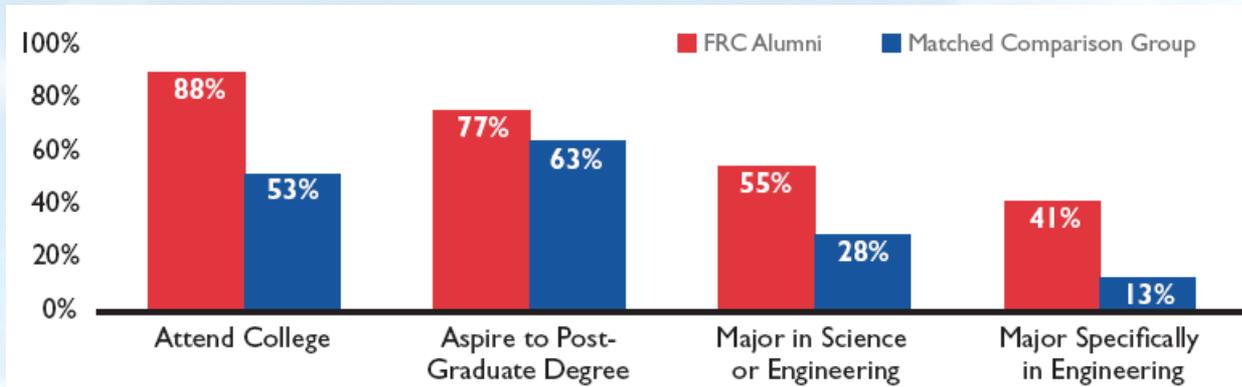
- 1810 Total Teams
- 48,000+ Students
- 44 Regional Competitions
- NASA teams from every center
- 340 teams advance to Championships

 NASA Sponsored Teams
 Directly Supported Students
 NASA Supported Regionals

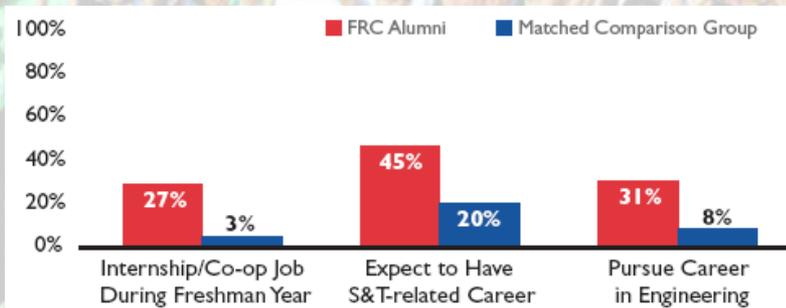


Effectiveness

- Participating students seek education in science & technology
 - Twice as likely to major in science or engineering (vs. comparison group)
 - More than three times as likely to major specifically in engineering

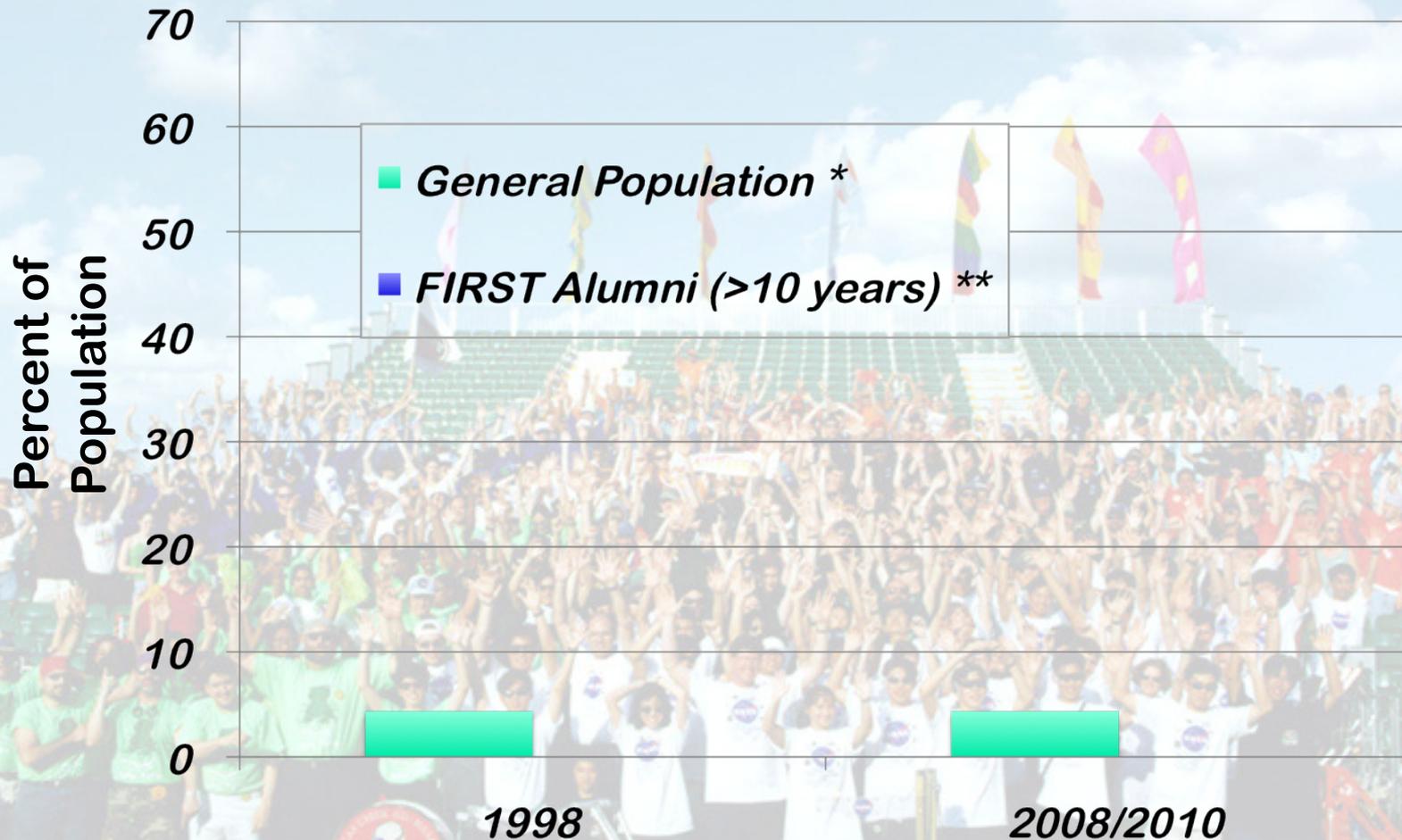


- Participating students earn Career Opportunities:
 - Almost ten times more likely to have internship
- Participating students are expected to Pursue Science & Technology Careers:
 - More than twice as likely to pursue S&T career
 - Nearly four times as likely to pursue career specifically in engineering



Source: Brandeis University, Center for Youth and Communities, Heller School for Social Policy and Management

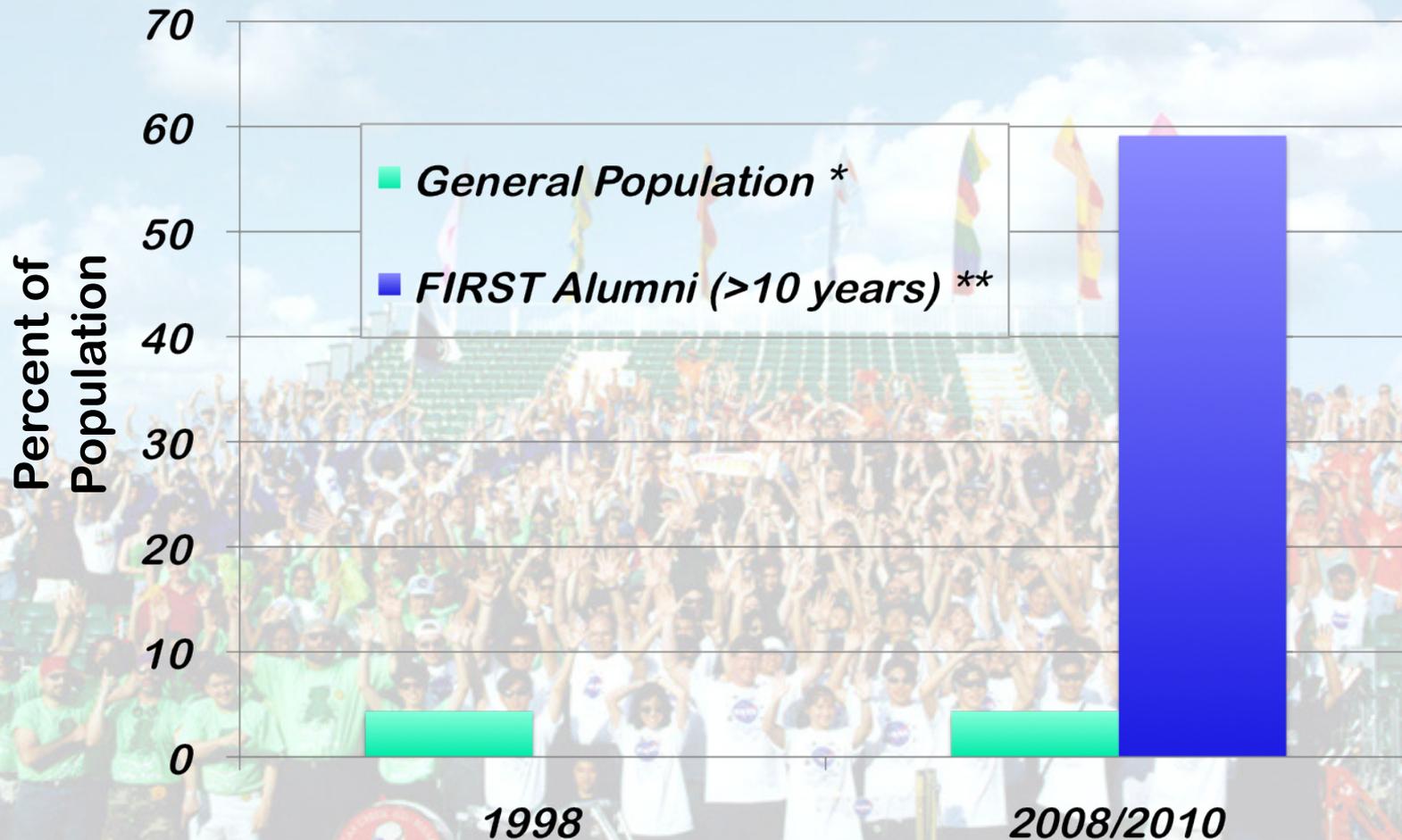
Population Fraction Employed In Engineering, Math, Science and Computer Careers



* Source: U.S. Bureau of Labor Statistics, May 2008 Databook

** Source: NASA House Teams Alumni Study, preliminary results

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The Impact

- Expose future engineers to NASA
- Early graduates already becoming involved with aero-space efforts – we are already hiring early program participants
 - JSC Automation, Robotics and Simulation Lab
 - JPL Robotics Lab, MSL, etc
- Changing the lives of students and engineers
- High visibility with low cost
 - White House (NASA Hq team invited to the White House twice in past year)
 - Congressional (e.g. Congressional Robotics Caucus, Congressional Technology Caucus, University Research Day, Havoc On The Hill, etc.
 - Mass media



Impact Case Studies

- Steven Lugo – an exceptional spirit
- Chatsworth High School, Los Angeles, CA
 - 60% students graduate
 - Less than 50% go on to college
 - Every FIRST participant graduated on time, attended college and many enrolled in honors and advanced placement course
- East Tech High School
 - “Just a few years ago...an urban school...slated for closing. Weve become the science/engineering magnet school... More students try out for FIRST team than football and basketball combined.”
 - Enrollment from 900 to 1400, attendance rates from 60% to 82%
 - FIRST team all graduated, all received scholarships including Case Western Reserve, Cornell, MIT, Air Force Academy, Ohio State, Georgetown



Who Else Participates In FIRST?

More than 3000 sponsoring companies, agencies, universities, and organizations including:

- NASA (the largest participant)
- Motorola
- General Motors
- Chrysler
- Boeing
- Johnson & Johnson
- Baxter Healthcare
- United Technologies
- Texas Instruments
- Lockheed Martin
- Oceaneering
- Ford
- U.S. Navy
- U.S. Coast Guard
- Raytheon
- Xerox
- Hamilton Standard
- Fairchild
- General Electric
- TRW
- Honeywell
- ... and many, many more



BAE SYSTEMS

Baxter



MOTOROLA



**Rockwell
Collins**



DEKA



DELPHI

**Rockwell
Automation**

**Boston
Scientific**

GM

Johnson & Johnson

FedEx

SAIC
From Science to Solutions

The Chrysler Foundation

LEGO



The Bottom Line

- NASA is the largest sponsor, by far, of the FRC program
 - In terms of students, team, and events sponsored
- This is a low expense, high return opportunity
- We are continuing to encourage agency employee participation
 - Participating engineers are our greatest asset and contribution
- Participation is in our own best interest
- Don't discount the rejuvenating effect on engineers and scientists

